

**RADIATION PROTECTION PLAN**  
**(ADDENDUM TO THE HEALTH AND SAFETY PLAN)**  
***Remedial Action***  
***Site 12 Final Remedy Removal Action***  
***Treasure Island***  
***San Francisco, California***

***Environmental Multiple Award Contract***  
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**Health and Safety Plan Addendum  
Radiation Protection Plan**

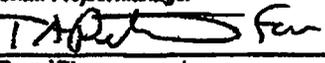
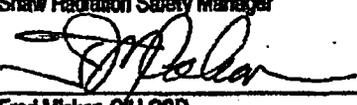
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Addendum Summary

This safety addendum is applicable to the following activities:

- Shallow excavation of top soil and subsoils for land use conversion. Potential for impact by any of the following: Technically Enhanced Naturally Occurring Radioactive Material (TENORM), source or byproduct material.

The specific requirements of this addendum and the general requirements of the Final Health and Safety Plan are mandatory for all personnel performing the aforementioned activities.

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TREASURE ISLAND  
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RADIATION PROTECTION PLAN  
(ADDENDUM TO THE HEALTH AND SAFETY PLAN)  
REMEDIAL ACTION  
FINAL REMEDY REMOVAL ACTION

DATED 03 AUGUST 2007

THIS RECORD IS ENTERED IN THE DATABASE AND FILED AS

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Appendix A Health and Safety Plan Addendum Acknowledgement Form

## ***Acronyms and Abbreviations***

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ALARA	As Low As Reasonably Achievable
CFR	Code of Federal Regulations
CHP	Certified Health Physicist
HSP	Health and Safety Plan
mrem	millirem
mrem/hr	millirem per hour
NRC	U.S. Nuclear Regulatory Commission
NWT	New World Technology
PM	Project Manager
QC	quality control
Radium	Ra-226
RPP	Radiation Protection Plan
RPM	Radiation Protection Manager
RSO	Radiation Safety Officer
Shaw E & I	Shaw Environmental and Infrastructure, Inc.

## **1.0 Purpose/Introduction**

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This Radiation Protection Plan (RPP) is provided to support work performed by Shaw and its contractor, New World Environmental, Inc., d.b.a New World Technology (NWT) at Site 12, a designated solid waste disposal area (SWDA), on Treasure Island, San Francisco, California.

Primary contaminants of concern included organic hydrocarbons (*i.e.*, polyaromatic hydrocarbons, dioxins, polychlorinated biphenyls) and lead. Radium (Ra-226) is also of concern having been previously found in the area. Ra-226 has been known to have been used for deck markers, decorative illumination devices, and on some dials and gauges used on military equipment. The period of use of these kinds of materials dates from the 1930s through the 1960s. Some disposal may have occurred after the useful life of the commodity. Therefore there is potential for material to be present that meets the new definitions of the most recent revision to U.S. Nuclear Regulatory Commission's (NRC) 'byproduct rule.'

All Shaw E&I/Shaw Environmental, Inc. project participants performing work around radioactive material (or suspected radioactive material) at the site must read this RPP and verify that they understand its content by signing the agreement and acknowledgement sheet, included as Appendix A, "Health and Safety Plan Addendum Acknowledgement Form."

NWT has a RPP for this project. Shaw E&I/Shaw Environmental, Inc. also have a policy for RPPs. The Policy, HS700 for developing Radiation Protection Plans cannot be waived. Any element in HS700 not covered in NWT's RPP must be addressed in Shaw E&I/Shaw Environmental, Inc.'s RPP. This document has been prepared to have the information provided by NWT to conform to the organization of HS700 to assist Shaw Staff in establishing and meeting all organizational requirements.

### **1.1 Policy**

It is Shaw Environmental, Inc.'s policy that all work with radioactive materials or ionizing radiation be purposeful and performed in a manner that protects workers, members of the general public, and the environment. Work involving radiological hazards may not begin unless that work can be performed in a safe manner, compliant with rules and regulations. Moreover, Shaw E&I/Shaw Environmental, Inc. endorses and applies As Low As Reasonably Achievable (ALARA) principles.

### **1.2 Project-Specific Radiation Protection Plan**

This RPP addresses all key elements required by Shaw Environmental & Infrastructure, Inc. (Shaw E & I) Procedure No. HS700, "Policy and Guidance for Developing Radiation Protection

Plans” (Shaw E & I, 2006). The function of this RPP and associated procedures is to provide all necessary information to meet project or license-specific requirements, regulations, and commitments. Supplemental surveys shall be performed to monitor personnel and equipment to ensure safe operations from handling or contact with radioactive material.

### **1.3 As Low as Reasonably Achievable Program**

The ALARA principles are incorporated into this RPP and supporting documents these are defined by the ‘Definitions’ found at 10 Code of Federal Regulations (CFR) 20.1003:

*“Every reasonable effort to maintain exposures to radiation as far below the dose limits in this part as is practical consistent with the purpose for which the licensed activity is undertaken, taking into account the state of the technology, the economic of improvement in relation to the benefits to the public health and safety, and other societal and socioeconomic considerations, and in relation to utilization of nuclear energy and licensed materials in the public interest.”*

Whether an activity is specifically licensed or not is not really material to the definition. Under NRC’s new Byproduct Rule, any material found or stored for later disposition would be licensable material. Several techniques will be used on this project to minimize radiation exposure. Occupancy time in the work area will be limited to necessary work. Handling any radioactive objects can be accomplished with gloved hands and by using a buddy system, the amount of actual handling of any radioactive object can be minimized (*e.g.*, one person holds a gallon or quart size baggy while another in glove hands picks up the item with tongs). Based on experience gained on projects with similar commodities, the actual external exposure for the duration of the project is expected to be less than 100 millirem (mrem) Total Effective Dose Equivalent (TEDE). Internal exposure may occur as a result of resuspension of fine material which may be either inhaled or ingested, therefore, measure to control dust are important. This includes using water as a dust suppressant, chemical crusting agents, or stopping work in the event that a high wind event occurs (typically defined as resulting in opacity greater than 10% for fugitive dust from a construction area) and other dust control measures become ineffective. The internal pathways Inhalation/Ingestion are anticipated to be less than 2 mrem Committed Effective dose Equivalent. This analysis suggests that the external exposure is limiting, so the most effective ALARA control will be to limit worker’s presence, ‘occupancy’ in the high dose areas only to necessary tasks. In the event that there is generation of excessive dust, then there will be application of water or crusting agents to minimize dust. If very windy conditions make dust control impossible, suspension of work may be implemented until winds subside.

## **1.4 Authorization to Stop Work**

All employees working at the site have authorization to stop work if an unsafe condition exists or a safety procedure(s) is being disregarded in accordance with Shaw E & I Procedure No. HS040, "Stop Work Authority" (Shaw E & I, 2006).

## **1.5 Scope of Work**

The scope of work from a radiological protection perspective will involve the following activities:

- Conduct task-specific training with personnel
- Perform site control and establish work zones associated any excavated area until the excavation and excavated materials have been surveyed and cleared (or radioactive commodities removed, bagged, inventoried and stored in a drum
- Work under NWTs radiation safety program

## **1.6 Quality Control and Auditing**

This section discusses the quality control (QC) and auditing associated with the implementation of this RPP.

### **1.6.1 Self-Assessment, Reviews, and Corrective Actions**

The duration of the project is expected to be several months. Periodic auditing or self-assessments will include evaluation of exposure rates present during excavation. A review of data and implementation of this RPP in the field shall be done by the Radiation Safety Officer (RSO) within the first month of the project. At that time the Radiation Protection Manager (RPM) shall establish the frequency of future reviews. The RPM or delegate may perform annual or more frequent radiation safety/compliance reviews of the project operation and records. The RSO, Project Manager (PM), and occupationally exposed individuals shall participate in such audits as requested.

### **1.6.2 Responses and Corrective Actions**

If serious deficiencies are noted, each will be tracked as radiological occurrences. The RSO and PM shall develop and implement a Corrective Action Plan with specifically assigned tasks and a schedule for completion. Corrective actions must be taken in a timely manner. The Corrective Action Plan is subject to review by the RPM.

### **1.6.3 Daily Instrumentation Check**

It is anticipated that instrumentation will be used, operated and maintained by NWT. It is routine practice and an NWT commitment, that each day a radiation protection instrument is used for

making a field measurement, the instrument shall be checked for background and source response prior to use. If an instrument response does not pass the QC test, the QC test shall be repeated. If the instrument still does not pass the QC test the instrument shall be taken out of service immediately. The RSO shall be informed of the failure of an instrument. Since radiation measurements are a critical activity, certain portions of the project may need to be suspended pending the arrival of an instrument that is qualified on the project site to be capable of making those measurements.

All instruments in use shall have current calibrations. If any of these practices are found to be deficient in NWT's program, NWT's work may be suspended and instrumentation will be acquired by Shaw Environmental, Inc. to continue to implement an effective, competent monitoring program.

## 2.0 Radiation Protection Personnel

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This section defines the responsibilities of key radiation protection personnel for the project. The safety responsibilities of other personnel are specified in the *Final Site Health and Safety Plan Site 12 Final Remedy Removal Action Treasure Island, San Francisco, California* (HSP) (Shaw, 2007). Table 1, "Radiation Protection Personnel," lists the project-specific Shaw personnel and their respective responsibilities.

### 2.1 Radiation Protection Manager

The RPM is responsible for overall implementation of the RPP.

### 2.2 Radiation Safety Officer

The RSO is that individual assigned authority to implement a site, project, or task order specific RPP. ***Roles not fulfilled by the subcontractor, NWT for the RSO must be provided by Shaw staff.*** Under the direction of the PM, the RSO shall implement the RPP, including task-specific activities. Additionally, the RSO may act as the Radiation Protection Technician (RPT) for this project, or as an RPT supervisor. The RSO is responsible for:

- Ensuring exposure to radiation is maintained ALARA.
- Reporting survey findings and instrument performance data to the RPM who will provide interactive guidance throughout the life of the project (if necessary).
- Ensuring appropriate instrumentation, protective devices, dosimetry (only when and if required, *i.e.*, if not performed by NWT, as they have committed to doing), training, and other items needed to perform work in accordance with elements of this RPP, are available.
- Properly operating radiation-measuring equipment, performing daily source, and background checks (if necessary).
- Maintaining radiation-measuring equipment according to manufacturer recommendations.
- Conducting radiological surveys and performing radiological sampling tasks as specified (spot checking anticipated, more comprehensively, if deficiencies are found in NWT's program).
- Stopping work if necessary to ensure radiation safety
- Maintaining communication to the RPM as needed to ensure that this RPP is fully implemented.

- Participating in the periodic internal and external review of RPP content and implementation.
- Preparing and maintaining reports and notices as required by this RPP.
- Acting as a primary project point of contact for radiation safety related communications.
- Ideally, either the RSO or the RPM will be a Certified Health Physicist (CHP), certified by the American Board of Health Physics.

### **2.3 Project Manager**

The PM is responsible for ensuring the following:

- Work is conducted safely and in compliance with all applicable permits, licenses, client contracts, and other applicable controlling documents.
- This RPP is developed and approved in a timely fashion.
- Exposure to radiation is maintained ALARA.
- Adequate resources and staffing are available to develop and implement this RPP in compliance with applicable regulations and requirements.

### **3.0 Task-Specific Hazard Analysis/Controls**

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The likely and possible radionuclides added to project hazards listed in Section 4.0 of the *Final HSP* (Shaw, 2007) will be listed in a Table. Uneven terrain, slips, trips, falls sharp objects, pinch points are all hazards in addition to radiation exposure.

#### **3.1 Identification of Radiation Hazards**

Ra-226 is the most likely source to be encountered. Sources in electron tubes are the most likely other sources, whose isotopes vary, isotopes include H-3, C-14, Co-60, Ni-63, Kr-85, Cs-137, Pm-147, Pb-210, Ra-226, and Th-232 in picocurie (pCi) to microcurie ( $\mu$ Ci) quantities. After seven months of project execution, only radium-bearing metallic debris and soils bearing low levels of radium contamination have been recovered. This experience lowers the probability that either electron tubes or other types of radioactive materials will be found. To date the most remarkable of the radium-bearing materials are ½ inch octagonal foils with exposure rates of up to 10 roentgens per hour (R/hr), but more typically, 300-700 mrem/hr. at contact. Radioactive Material storage areas housing recovered debris have higher levels of radiation, but Shaw staff do not have access to the storage area. Vigilance for changing conditions continues, which is appropriate for all excavations into areas with incomplete documentation.

#### **3.2 Identification of Controlling Agencies and Documents**

NWT possesses a Type A Broad Scope License from the Nuclear Regulatory Commission, RML #04-27745-01. Work is performed under the Treasure Island Naval Station, Site 12 Final Remedy Removal Action Work Plan. NWT also has a complete set of Field Operations and Technical Procedures. Since California is an agreement state and the License is issued by an NRC, both Federal Regulations 10 CFR 20, and California Code of Regulations, Title 17 apply to radiation control. In addition industrial safety is covered under 29 CFR. Environmental Protection Agency (EPA) regulations under 40 CFR also have applicability for a variety of different regulatory subjects including Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), Resource Conservation and Recovery Act (RCRA), and National Emission Standards for Hazardous Air Pollutants (NESHAP).

#### **3.3 Evaluation of Potential Exposure to Workers**

Dose limits governing this project are those of 10 CFR 20 (and equivalent California Regulations).

Most of the dose is expected to come from Radium from external radiation exposure, localized at levels up to about 1 mrem/hr., but more typically much less. A job with similar commodities

was completed with no measurable dose recorded on Optically Stimulated Luminescent (OSL) dosimetry.

### **3.4 Evaluation of Public Dose**

Based on the scope of work; the limited activity of radionuclides expected; and the involved Naturally Occurring Radioactive Materials levels anticipated on surfaces, public dose due to work activities at this site is anticipated to be less than 1 mrem. This also is below a threshold for air monitoring under 40 CFR 61 Subpart H, 'Rad NESHAPs.' NWT has committed to performing air sampling.

### **3.5 Training Program Development**

Since worker exposure is substantially under 100 mrem per individual but more likely under 10 mrem, the training required for radiation safety is not too extensive. NWT's radiation safety staff are trained to ANSI 3.1 standards.

### **3.6 Declared Pregnant Woman Program**

Women may claim pregnancy in writing in accordance with 10 CFR 20 and NRC Regulatory Guides 8.13, U.S. Nuclear Regulatory Commission, 1999, Regulatory Guide 8.13, *Instruction Concerning Prenatal Radiation Exposure*, Revision 3, Washington, D.C and 8.29, U.S. Nuclear Regulatory Commission, 1996, Regulatory Guide 8.29, *Instruction Concerning Risks from Occupational Radiation Exposure*, Revision 1, Washington, D.C.; however, due to the small anticipated dose, it is unlikely that separate dose tracking will be required. It is planned to manage an individual to maintain a dose below 100 mrem (the NRC has established a dose limit of 0.5 rem (*i.e.*, 500 mrem for the dose to the fetus during the term of pregnancy). Given the anticipated dose this issue is moot.

### **3.7 As Low as Reasonably Achievable Program**

See Section 1.3 for this program.

### **3.8 External Exposure Control**

External exposure is from gamma radiation, X-rays and beta radiations. The following steps are taken to control external radiation exposure to levels that are ALARA:

- *Basic dose reduction strategies are employed using the concepts of time and distance are used to control external exposure and minimize dose.* Working efficiently in any work area requires advance planning. Morning meetings shall include a review of activities planned and should include a review of radioactive materials encountered and good work practices. Workers who have no tasks to perform in areas known to have radioactive materials and areas that have not been surveyed should not go into those areas.

- *Instrumentation is routinely used to determine the level and extent of radiation fields. Gamma survey instruments shall be on prior to and as approaching work areas, shall be on at all times that materials are being moved closer to workers, and shall be used for screening materials.*
- *Workers have been trained to (visually) look for objects that might be radioactive, and to be wary of objects that are unfamiliar, and rely on instrument readings to limit and manage external exposure.*

### **3.9 Internal Exposure Control**

Due to the expected inventory and magnitude of the activity of objects anticipated in this project and the ease with which the material can be handled to minimize the potential for internal exposure, the best practices implemented will preclude the potential for internal deposition. Internal exposure is expected to be less than 1 mrem.

### **3.10 Monitoring and Measuring External Exposure**

NWT has committed to providing external dosimetry (the vendor and type will be verified prior to the project start, but it is anticipated to be a suitable vendor, *i.e.*, National Voluntary Laboratory Accreditation Program (NVLAP) accredited (either film badge, OSL or Thermal Luminosity Device [TLD] media, any of which is acceptable). All Shaw field staff will be issued dosimetry exchanged on monthly intervals in order to generate a durable record of employee exposures. Several octagonal foils have been recovered with exposures at contact of up to 300 to 700 mrem/hr. One foil has been found with an exposure rate of 10 R/hr at contact. This is a higher level than originally planned, and necessitated revising this RPP.

### **3.11 Monitoring and Measuring Internal Exposure**

Due to the low levels of internal exposure anticipated, monitoring of internal exposure is not required. The RSO will re-evaluate the risk of internal exposure, appropriate measures, and may change this if certain unanticipated items are found. At the present time, while this topic could be dispensed as “not applicable,” NWT has committed to performing air sampling to confirm that bioassay is not needed.

### **3.12 Surveys and Monitoring**

NWT has provided extensive survey and monitoring information in sections 4.8 through 6.1.6 of their *Final Radiological Sampling and Analysis Plan, Site 12 Removal Remedy Action, Rev. 3*, dated July 4, 2007. Ultimately, protection of workers, the public and the environment require meeting the clean-up criteria established by the stakeholders and these are achieved by surveying with field instruments, or soil sampling and subsequent analysis in accordance with prescribed and approved procedures.

### **3.13 Contamination Control**

NWT has provided extensive contamination control and control of work procedures which are presented in *Final HSP Rev. 3* (NWT, 2007).

In addition, if radioactive materials are discovered during excavation and surveying activities a RWP will be prepared that will specify the radiological safety requirements for activities performed under this RSAP. Personnel assigned to site work will be required to understand the requirements and sign the RWP prior to beginning work.

Only pre-authorized areas will be used to store radioactive materials at TI. These areas will be selected with concurrence of RASO, the RSO, and the CSO. Security measures for these areas will be coordinated with the CSO and the Shaw or subcontractor NRC licensee.

Radioactive material handling activities must be performed in a manner to ensure the following:

- Access to areas is restricted where radioactive materials are known to be present.
- Surveys of radioactive materials storage areas are completed at least weekly.
- Radioactive material inventories are kept up-to-date.

### **3.14 Instrumentation**

NWT has provided extensive instrumentation documentation which is presented beginning in *Final HSP Rev. 3* (NWT, 2007).

### **3.15 Radiological Areas Posting/Labeling**

A Radioactive Materials Area (RMA) is kept in the Area 6 bin storage area. Only the following two postings (signs) are anticipated: (1) "Caution Radioactive Materials" and (2) "Caution Any Container in this Area May Contain Radioactive Materials."

### **3.16 Control of Radiological Work**

NWT has provided extensive details of how radiological work will be controlled in Sections 4.5-4.6 of their *Final HSP Rev. 3* (NWT, 2007), the text of their program is presented in Section 3.13 Contamination Control, above.

### **3.17 Credentialing of Staff**

NWT follows ANSI 3.1 criteria for technician staff. NWT holds a broad scope NRC license and has an RSO who is also National Registry of Radiation Protection Technologists (NRRPT) qualified.

In addition project oversight by Shaw Environmental, Inc. includes an

- American Board of Health Physics Certified Health Physicist, *i.e.*, a CHP

### **3.18 Procurement, Receipt, and Inventory**

The project will not be receiving Radioactive Materials Shipments, except check sources in exempt quantities. The exempt quantity sources do not require leak testing. Sources will be inventoried on 6-month intervals.

### **3.19 Shipping and Transportation of Radioactive Materials**

Not applicable.

### **3.20 Control of Radioactive Waste**

Not applicable.

### **3.21 Radiation Protection Records**

The NWT Project Manager is responsible for reviewing data for accuracy and completeness before on-site activities are concluded. Electronic records may be substituted, provided appropriate access authorization procedures are in place and quality assurance requirements are met.

All data, notes, measurements, calibrations, and other information pertinent to a survey site must be recorded and maintained. Records must conform to the following basic requirements:

- Marked with date of entry.
- Signed or initialed (by hand or electronically) by the author of the entry.
- Written or printed in a legible manner.
- Contain all pertinent information in a concise, accurate entry.

Column headings or requested information on record data forms may be inappropriate or incorrect for specific site situations. If so, appropriate handwritten changes must be made on the forms. When certain information requested on the presented form is not required, the space or columns should be crossed through or marked "NA" (not applicable) as an indication that such information was not required, rather than having possibly been forgotten.

If data corrections are necessary a single line will be drawn through the entry. New data, initials of the surveyor, and date of correction will be recorded. Data will not be obliterated by erasing or with the use of white-out.

All training records and accident investigation documents will be maintained. The training records will include brief biographies (resumes) certifications, or documents that demonstrate the qualifications of the personnel performing the work.

The Final Status Survey Report will contain records and information necessary to document and support the Final Status Survey effort. All generated records for the project shall be maintained in the on-site office. Records that must be controlled and maintained during the project and presented in the Final Status Survey Report, in addition to site activities include but are not limited to:

- Description of survey design
- ALARA evaluation/discussion
- Instrument calibration data
- Description of area to be released and its radiological use and history
- Daily instrument performance check data
- Instrument efficiency determination data
- Survey records
- Dates surveys were performed
- Survey results and data
- Description of instrumentation used
- Instrumentation MDC calculations
- Smear sample location records
- Identification of release limits used
- Sample analysis results
- Survey maps and photographs
- Quality control data;
- Comparison of survey results to release limits; Shipment and receipt of radioactive materials records
- Dose estimates and reports and supporting documents
- Training records
- Dose reports

Listed records will be maintained on site during project activities. All listed records will be transmitted with the final project report and maintained at the NWT corporate office in Livermore, CA.

In addition to records listed above, records relating to self-assessments, periodic reviews, audits, radiological occurrences, corrective actions and other responses to such findings or incidents also trigger recordkeeping requirements, all radiation protection records will be forwarded to Shaw Environmental, Inc. RPM.

Records will be retained for a minimum of three years or as long as contractual requirements specify, whichever is longer.

### **3.22 Reports and Notifications**

Workers who have had previous work history with radiological hazards shall supply the RSO with copies of their estimated or reported dose histories.

If personnel are provided external dosimetry monitoring devices, records of radiation exposures to workers shall be maintained; each employee for whom such records are maintained shall be advised of his/her individual exposure annually.

In addition, some matters such as radiological occurrences and incidents require reporting, as noted in the previous section.

### **3.23 Licenses**

NWT holds a Type A Broad Scope Radioactive Materials License issued by the NRC for their operations. The Gamma spectroscopy check source is used on a weekly basis but stored at an NWT facility off-site.

### **3.24 Review and Approvals of Radiation Protection Plans**

The PM, RSO, RPM, and Program Health and Safety Manager shall formally review and approve the RPP. In addition, the client will have an opportunity to review, provide input, and provide formal acceptance of the plan.

The RSO may make field changes to the RPP and supporting documents to facilitate use without approval provided radiation safety conditions at the site, Action Levels and expected doses are not impacted.

### **3.25 Planned Special Exposures**

There is no anticipated work within this scope that would require a planned special exposure.

## **4.0 Personal Protective Equipment**

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The RSO and Project Health and Safety Manger (HSM) have established the levels of protection for the site activities. The primary level of personal protective equipment, Modified Level D, is sufficient for field survey, excavation, removal, and decontamination activities associated with the remediation of any radioactive commodities or waste found. For details regarding Level D – Modified Protection, refer to the *Final HSP* (Shaw, 2007).

## **5.0 Radiological Survey, Removal, and Decontamination Procedures**

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NWT will be fulfilling this function. The following section details the procedures for surveying soil and solid waste for radiological materials, removal of any positively identified radiological materials, and decontamination for personnel exposed to such materials.

Gamma exposure rate instruments, surface contamination survey instruments, and a smear counter will be available at all times when work on or around radioactive material is in progress for purposes of detection of unexpected materials or levels, and contamination control.

### **5.1 Land Disposed Radiological Materials**

If the project staff has cleared an area for safe entry and it is amenable to surveillance for any kind of hazard, the area will be visually surveyed. A Ludlum Model 44-10 detector or a Ludlum Model 19 or equivalent instruments will be used for determining the presence of radioactive materials. Since some objects that have been encountered represent a group of well-known category of radioactive items, visual recognition may be possible before an instrument is used to confirm it. In addition, a frisking instrument would be useful in verifying that removable contamination is being controlled.

### **5.2 Personnel Decontamination**

Frisking personnel for surface contamination will be performed using a Ludlum Model 43-89 (or comparable instrument, such as a Ludlum Model 43-93-2 or 43-93 detector). If personnel are found to have skin contamination, soap and water are most likely to be highly effective in eliminating contamination. Due to the long period that any potential radioactive material has been in contact with soil, the potential for its reactivity to skin resulting in persistent skin contamination is low. If two rounds of decontamination by soap and water is unsuccessful in reducing contamination on the skin to an acceptable level, the individual will be referred for prompt medical assistance.

### **5.3 Equipment Decontamination**

Equipment will be surveyed for fixed contamination with a Ludlum Model 43-89, a Ludlum Model 43-93, or Ludlum Model 43-93-2 detector or equivalent. Removable contamination will be determined by collecting *and* by counting smears with a Ludlum Model 2929 detector to verify that the free-release criteria are met (see Table 3). Since contamination on surfaces involves a limited amount of material with limited thickness, a gamma scintillator or such as a Ludlum Model 19 has low efficacy for screening purposes for free release of equipment.

## **6.0 Air Monitoring**

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Air monitoring is being done by NWT. Dust monitoring such as a 'PM-10' passive monitoring device may be used to verify the efficacy of dust control measures.

## **7.0 Shipping and Transportation of Radioactive Materials**

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Not applicable, because analysis will be performed on-site using a gamma spectroscopy system.

In the event samples are to be shipped for off-site analysis, Department of Transportation (DOT) regulations require determining a transportation index (external exposure rate at about 1 foot), the surface contamination level on the package (determined by counting wipe samples in a Ludlum Model 2929 smear counter), and an estimate of the activity of the samples (available because the gamma spectroscopy system will furnish an estimate of the activity of the sample).

## 8.0 References

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Code of Federal Regulations, Title 10, Part 20, *Standards for Protection Against Radiation*, U.S. Government Printing Office via GPO Access, Washington D.C., January 1, 2003, <<http://www.gpoaccess.gov/cfr/index.html>>, May 2007.

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Code of Federal Regulations, Title 49, Volume 2, *Transportation*, U.S. Government Printing Office via GPO Access, Washington D.C., April 1, 2006, <<http://www.gpoaccess.gov/cfr/index.html>>, May 2007.

New World Technology. 2007. *Final Radiological Analysis and Sampling Plan, Site 12 Final Remedy Removal Action, Treasure Island San Francisco, California, Rev. 3*, July 4. Livermore, California.

Shaw Environmental & Infrastructure, Inc. (Shaw E & I), 2006, *Health and Safety Policies and Procedures Manual*, <<http://shawnet3.shawgrp.com/sites/handspps/default.aspx>>.

Shaw Environmental, Inc. 2007, *Final Site Health and Safety Plan Site 12 Final Remedy Removal Action Treasure Island, San Francisco, California*, February.

U.S. Nuclear Regulatory Commission (NRC), 1996, Regulatory Guide 8.29, *Instruction Concerning Risks from Occupational Radiation Exposure*, Revision 1, Washington, D.C., February.

U.S. Nuclear Regulatory Commission (NRC), 1999, Regulatory Guide 8.13, *Instruction Concerning Prenatal Radiation Exposure*, Revision 3, Washington, D.C., June.

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## *Tables*

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**Table 1  
Radiation Protection Personnel**

<b>Organization/ Company</b>	<b>Individual/ Phone Number</b>	<b>Project Role/ Responsibility</b>	<b>Phone Number</b>	<b>Email</b>
Shaw Environmental, Inc.	Dennis Brown	Radiation Safety Officer	(303) 741-7507 (720) 272-9915	Dennis.Brown@shawgrp.com
	David Hillyer	Radiation Protection Manager	(617) 589-1115 (217) 521-4721 (Cell)	David.hillyer@shawgrp.com
	Tom Peterson	Radiation Protection Operations Manager	(631) 245-3672 (Cell)	Thomas.Peterson@shawgrp.com
	Fred Mlakar	Program Health and Safety Manager	(949) 660-15413	Fred.Mlakar@shawgrp.com
	Peter Bourgeois	Project Manager	(415) 760-5321	Peter.Bourgeois@shawgrp.com
NWT	Doc Dennis	NWT Radiation Safety Officer	(916) 929-6977	doc@greer-construction.com

*CHP denotes Certified Health Physicist.*

*CSP denotes Certified Safety Professional.*

**Table 2**  
**Controlling Agency Contact Information**

Contact	Address and Phone Number
United States Nuclear Regulatory Commission Region IV Director, Division of Nuclear Material Safety	611 Ryan Plaza Drive, Suite 400 Arlington, Texas 76011 Phone: (817) 860-8221 Fax: (817) 860-8263
United States Environmental Protection Agency Region 9 Attention: Christine Katin	75 Hawthorne St., SFD-8-1 San Francisco, CA 94105-3901 Phone: (415) 972-3112 Fax: (415) 947-3520
State of California Department of Health Services Radiological Health Branch	P.O. Box 997414 Sacramento, CA 95899-7414 Phone: (916) 327-5106
State of California Department of Health Services California Environmental Management Branch Attention: Diedre Dement	P.O. Box 997413 Mail Station 7405 Sacramento, CA 95899-7413 Phone: (916) 449-5675
State of California Department of Health Services Department of Toxic Substances Control Attention: Henry Wong	700 Heinz Ave., Suite 200 Berkeley, CA 94710 Phone: (510) 540-3770 Fax: (510) 849-5285
U.S. Department of the Navy Southwest Division Naval Facilities Engineering Command	1220 Pacific Highway San Diego, California 92132-5187 Phone: (619) 532-2540 Fax: (619) 532-2607
U.S. Department of the Navy BRAC RPM Attention: James Whitcomb	455 Frazee Road, Suite 900 San Diego, CA 92108-4310 Phone: (619) 532-0936 Fax: (619) 532-0983
U.S. Department of the Navy ROICC SF Bay Area	2450 Saratoga St., Suite 200 Alameda, CA 94501-7545 Phone: 510-749-5948 Fax: 510-749-5949

**Table 3**  
**Free Release Criteria for Surface and Threshold for Use Engineering Controls**

Measured Parameter/ Threshold	Total Surface Alpha Contamination (dpm/100cm <sup>2</sup> )	Total Surface Beta Contamination (dpm/100cm <sup>2</sup> )	Total Removable Alpha Contamination (dpm/100cm <sup>2</sup> )	Total Removable Beta Contamination (dpm/100cm <sup>2</sup> )	Radiation level (external gamma radiation as seen by a field instrument, uncorrected) (μR/hr)
Free Release*	500	5,000	20	1,000	50 (at contact)
Minimal Engineering Controls **	500 < x < 50,000	5,000 < x < 500,000	20 < x < 2000	1,000 < x < 100,000	50 < x < 2,000 (at 1 foot)

*Notes:*

\* Material found to exceed the free release criteria shall be segregated from material that does not exceed the free release criteria. Free Release Criteria are developed from Army regulations and NRC Regulatory Guide 1.86.

\*\* Levels that exceed the upper limiting values for surface contamination triggers evaluation of additional engineering controls and procedures. Work shall be suspended until guidance is received from the RSO.

Radiological Control of an area formally begins when the 2000 μR/hr. threshold is reached. Work shall also be suspended when the 5000 μR/hr. threshold is reached. Posting as a Radiation area would be required at 5000 μR/hr. At this level there would be a change in work control as a formal radiation work permit program would need to be implemented.

dpm denotes disintegrations per minute

μR/hr denotes microRoentgens/hour

50 μR/hr times 2000 hours = 100 mrem, which is the limit for a non-radiation worker.

**Table 4  
Regulatory Limits and Action Levels**

Type	Dose Limit or Action Level
Regulatory Limit	
Public (TEDE)	100 mrem, annual
Total effective dose equivalent (TEDE)	5000 mrem, annual
CDE to any organ except skin & lens of eye	50000 mrem, annual
Lens of eye	15000 mrem, annual
Shallow dose equivalent (SDE) to skin of whole body and extremities	50000 mrem, annual
Dose rate to public	2 mrem in any one hour
Action Level	
Action level for additional training	Greater than 100 mrem, annual, expected
Action level for requiring individual monitoring	Greater than 500 mrem , annual, expected
Action level for requiring decontamination or storage/disposal with radioactive materials	Greater than Table 3 release levels
Action level for requiring engineering controls	100 times Table 3 release levels
Action level for RPT assistance and decontamination of personnel	Readings above background levels on personnel
Action Level for notification of RPM and suspending work in the area	Unexpected materials with radiation hazard or high dose rate objects  High levels of contamination found  Exit signs

*Note:*

*1 denotes RPM may require monitoring at levels below the action level for purposes of ensuring compliance.*

***Appendix A***  
***Health and Safety Plan Addendum***  
***Acknowledgement Form***

